SERVICE MANUAL

HD/HR RANGE OF SERVOMOTORS

ISSUE 2

WARNING

Servomotors contain magnetic material which will attract metal particles. Care should be taken when dismantling motors to avoid this.
All D.C. servomotors manufactured by SEM contain magnets which are air stable and can be dismantled without demagnetisation

SEM
controlled motor technology

HD/HR55

servicing instructions

1 GENERAL

1.1 Before starting work on the motor, these servicing instructions should be read and fully understood.

1.2 Servicing of SEM motors must be done only by suitably trained and qualified personnel, and only after such motors have been electrically isolated and removed from their mechanical drives.

1.3 The jaws of any vice or clamp must be suitably protected when used to grip any part of the motor.

1.4 When separating the motor end covers from the motor body, care must be taken to avoid damage to their mating surfaces.

1.5 NOTE. There are strong magnetic forces between the stator and the rotor of all SEM servomotors. Fingers should be kept clear of the gaps between the stator and end covers during assembly and disassembly of the rotor.

1.6 Dismantled components awaiting reassembly should be kept in a safe, clean and dry location.

Various types of encoder are used, involving different procedures for dismantling, reassembly, connection, setting up and testing. Contact SEM with regard to relevant servicing procedures for the particular type of encoder involved.

2 MARKING

2.1 The following relationships must be marked with a marker pen or other suitable method before dismantling.

2.2 Drive end (DE) cover (A) to motor body (B).

2.3 Non-drive end cover (D) to motor body (C).

2.4 Enclosing Cover (18) to non-drive end (NDE) cover (17).

2.5 Prior to resolver dismantling, mark outside end faces of resolver stator (4) and resolver rotor (3)

3 DISMANTLING THE MOTOR

3.1 Remove 4 M4 socket screws from N.D.E. enclosing cover (18), remove the end cover and the gasket.

3.2 Remove 8 screws (21) from D.E. cover (12).

3.3 For Sagem resolver this must be removed prior to dismantling of the motor, proceed as per instructions for tacho removal, for any other manufacturer check with SEM for instructions.

3.4 Withdraw D.E. cover with complete attached assembly of rotor (1), bearings (10 & 8), resolver rotor (3) and spacer (5). Remove circlip (11) and press out rotor shaft to separate from D.E. housing. Remove circlip (9) and remove bearing from D.E. housing. To remove resolver rotor (3) use bearing extractor tool behind the shoulder on spacer (5); the bearing can then be withdrawn. Handle the resolver assembly with great care at all times.

3.5 Before removing N.D.E., go through the disconnection sequence:

3.6 **Disconnection sequence.** PIN REMOVAL TOOL REQUIRED – available from SEM Ltd. Both connectors (23 & 27) must be removed before N.D.E. cover can be removed. Take out 4 screws, pull the socket forward to allow access to connector pins. Withdraw the connector pins using the pin removal tool. Pull wires through from feedback connector (23) to clear screw access; remove 4 screws (20) from N.D.E. cover. Withdraw the cover carefully to avoid damage to wiring.

3.7 **Removal of resolver.** Important: At all stages of removal and reassembly, the resolver unit must be handled with care. Unscrew (36) and release resolver body (4) complete. At this point the resolver rotor (3) is free and will drop out of the resolver body unless held in place by hand. Remove the resolver and store in a safe place until re-assembly.

3.8 **Removal of D.E. cover – Brake Models.** Remove 8 cover screws (21) then 3 screws (19) holding brake assembly. This allows cover to be removed, leaving the brake and bearing on the shaft and exposing the leads to the brake. Disconnect these leads and remove complete rotor assembly as Section 3.4. Pull the bearing off the shaft, leaving brake free to be removed. When this sequence is complete, continue as Section 3.4 above.

4 RE-ASSEMBLY OF THE MOTOR

To fit N.D.E. cover to body. Note: new circlips, oil seals and bearings must be fitted on the re-assembly as standard procedure.

4.1 Feed the thermal overload leads through the hole in the N.D.E. cover, feed the earth lead through the hole in the body and fit 4 cap head screws.

4.2 Fit the resolver to the N.D.E. cover with 3 screws and clamping washers (metal shield outwards), feed both resolver and thermal overload leads through the hole on the left of the N.D.E. cover.

4.3 Fit 2 connector elbows with cap screws and gaskets, bringing out the leads at the same time. Press the pins firmly into the back of the connectors until they click into place. Position the connectors and gaskets and tighten down with screws and washers.

4.4 Fit O-ring, bearing and circlip to D.E. cover, slide rotor into cover/bearing assembly. Slide bearing onto N.D.E. of shaft.

4.5 Supporting the inner race of the bearing, press both bearings into place. Fit spacer and tolerance ring to N.D.E. Fit circlip at D.E.

4.6 Carefully stand motor upright (with N.D.E. down). Locate the wave washer in the N.D.E. housing, lower the rotor/cover assembly very carefully into the body and screw the D.E. cover to the body.

4.7 Support and press into position (resolver rotor). Fit a new tolerance ring (2).

4.8 Fit brake, carefully press rotor into brake (ensuring that teeth line up correctly). Fit rotor to body as above, but connect and isolate 2 brake leads before pushing into place.

5 RESETTING THE RESOLVER.

5.1 This only applies to a standard resolver supplied by SEM with the standard setting. For any other resolver, refer to the drive manufacturer.

5.2 For these procedures it is necessary to make connections and links to feedback connector pins. To avoid damage to these pins, it is advisable to make such connections and links via a suitable separate test socket which mates with the feedback connector multi-pin plug (27) and which has short leads connected to its sockets. Alternatively appropriate pins can be made available for connections and links by withdrawing them from plug (27) as in Section 3.6 “Disconnection”.

5.3 If a brake is used, it must be temporarily held off during this operation by applying a 24V dc supply across the brake terminals.

5.4 Undo 4 screws (20) and pull back the enclosing cover (18) to give access to the resolver. With the above test plug connected to the feedback connector, link pins R1 to S3 & pins R2 to S2. Connect a signal generator (approx 5V 6kHz) between pins R1 and R2. Connect an AC voltmeter between pins S1 and R2.

5.5 At the power connector, link motor phase pins V and W and then connect a low voltage dc supply to motor phases at power connector pins U (+ve) and V+W (-ve). Adjust this voltage to give between 25% and 100% of motor rated current thereby causing the motor to turn to a preferred position.

5.6 Slacken the 3 screws holding the resolver stator and then rotate it until the voltmeter gives a maximum reading. Reconnect the AC voltmeter to pins S4 and R2. Make a small final adjustment of the resolver stator to get a minimum reading. Retighten the screws, disconnect the test socket, the supplies, the voltmeter and links, let the brake (if used) be re-applied.

5.7 Attach the protective shield (if fitted) to the resolver and fix the enclosing cover (18) to the NDE cover in accordance with marks made in operation 2.3.

6 ELECTRICAL TESTS NECESSARY BEFORE CONNECTING MOTOR TO AMPLIFIER.

6.1 Measure motor stator winding resistances U-V, V-W, W-U. These must be equal to within 3%.

6.2 Check dielectric strength by flash test at 1000 Vac from:

- a Phase U (power connector pin) U to motor body.
- b Phase U to thermal sensor (feedback connector pins Thermal Sensor + and Thermal Sensor -).
- c Phase U to brake connections (power connector pins B+ & B-).

If flash test is not possible then check that insulation resistance is greater than 1megaohm.

6.3 Check dielectric strength by flash test at 500Vac or with a 500Vdc supply from motor body to:

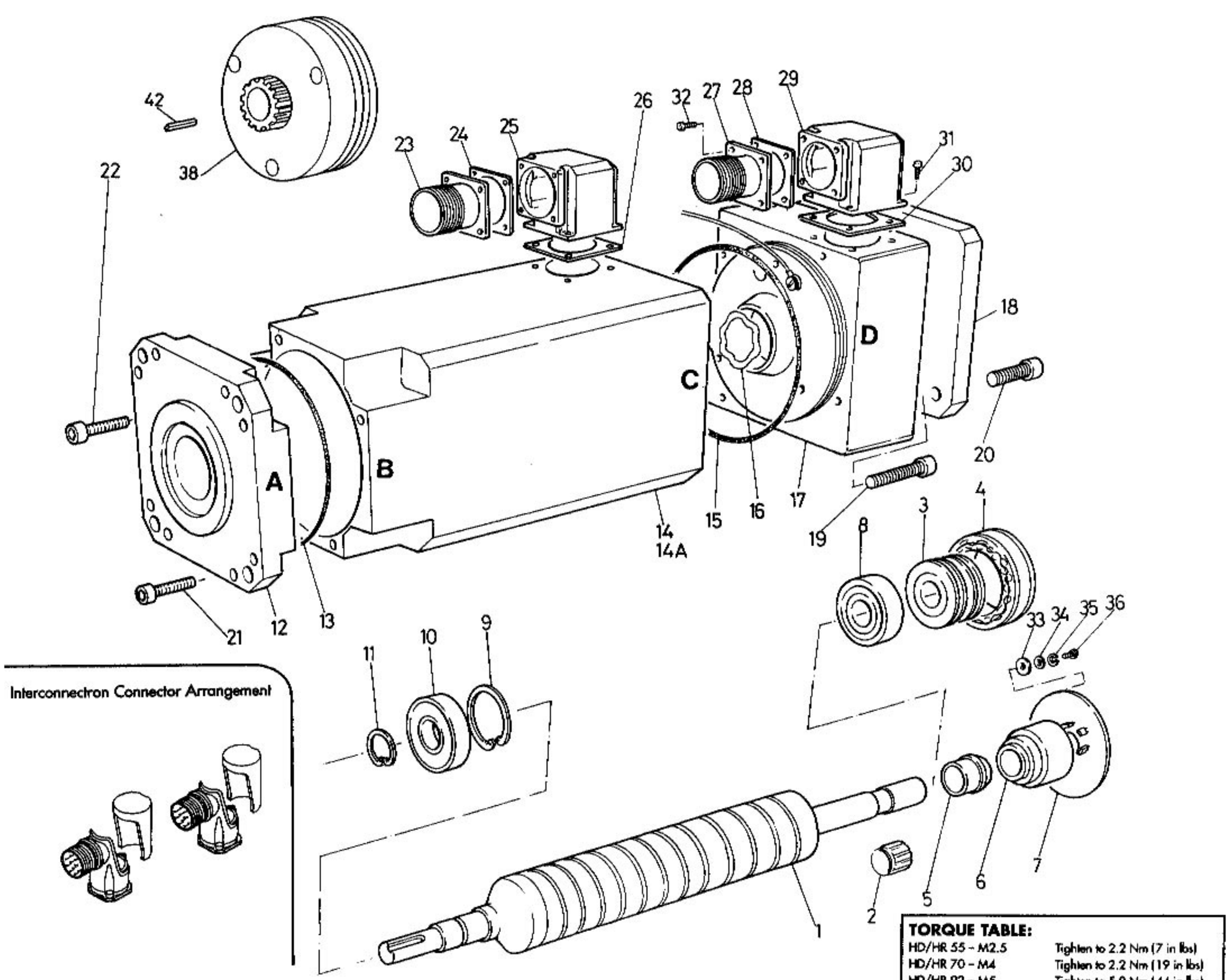
- d Brake connections (power connector pins B+ and B-)
- e Thermal sensor (feedback connector pins Thermal Sensor + and Thermal Sensor -)
- f Resolver (feedback connector pins R2 and S1.

If flash test is not possible then check that insulation resistance is greater than 1megaohm.

SEM Limited, Faraday Way, Orpington, Kent BR5 3QT England
Telephone: +44 (0)1689 884700 • Fax: +44 (0) 1689 884884
E-mail: info@sem.co.uk • Internet http://www.sem.co.uk

HD/HR55 parts list

ITEM NO.	DESCRIPTION
1	Rotor Assembly
2	Tolerance Ring
3	Resolver Rotor
4	Resolver Body
5	Spacer (Non tacho motors only)
6	Tachogenerator Rotor Assembly
7	P.C.B. Assembly
8	N.D.E. Bearing
9	Bearing Retaining Circlip
10	D.E. Bearing
11	Bearing Retaining Circlip
12	D.E. Cover
13	D.E. 'O' Ring
14	Motor Body
14a	Long Motor Body for Brake Motor
15	N.D.E. 'O' Ring
16	Wave Washer
17	Non Drive Encl Housing
18	N.D.E. Enclosing Cover
19	N.D.E. Housing Fixing Screw
20	N.D.E. Cover Fixing Screw
21	D.E. Cover Fixing Screw
22	Fixing Screw: Brake
23	M.S. Connector: Power
24	Gasket
25	Connector Housing
26	Gasket
27	MS Connector: Feedback
28	Gasket
29	Connector Housing
30	Gasket
31	Fixing Screw: Cap-head
32	Fixing Screw: Cheese-head
33	Plain Washer M4
34	Plain Washer M3
35	Single-turn Coil Spring Washer
36	Fixing Screw
37	Brake Key (Optional)
38	Brake (Optional)



TORQUE TABLE:

HD/HR 55 – M2.5	Tighten to 2.2 Nm (7 in lbs)
HD/HR 70 – M4	Tighten to 2.2 Nm (19 in lbs)
HD/HR 92 – M5	Tighten to 5.0 Nm (44 in lbs)
HD/HR 115 – M5	Tighten to 5.0 Nm (44 in lbs)
HD/HR 142 – M6	Tighten to 8.0 Nm (71 in lbs)
BMR 190/HD190 – M10	Tighten to 25.0 Nm (221 in lbs)

SEM controlled motor technology
SEM Limited, Faraday Way, Orpington, Kent BR5 3QT England
Telephone: +44 (0)1689 884700 • Fax: +44 (0) 1689 884884
E-mail: info@sem.co.uk • Internet http://www.sem.co.uk

HD/HR70

servicing instructions

1 GENERAL

1.1 Before starting work on the motor, these servicing instructions should be read and fully understood.

1.2 Servicing of SEM motors must be done only by suitably trained and qualified personnel, and only after such motors have been electrically isolated and removed from their mechanical drives.

1.3 The jaws of any vice or clamp must be suitably protected when used to grip any part of the motor.

1.4 When separating the motor end covers from the motor body, care must be taken to avoid damage to their mating surfaces.

1.5 NOTE. There are strong magnetic forces between the stator and the rotor of all SEM servomotors. Fingers should be kept clear of the gaps between the stator and end covers during assembly and disassembly of the rotor.

1.6 Dismantled components awaiting reassembly, should be kept in a safe, clean and dry location.

Various types of encoder are used, involving different procedures for dismantling, reassembly, connection, setting up and testing. Contact SEM with regard to relevant servicing procedures for the particular type of encoder involved.

2 MARKING

2.1 The following relationships must be marked with a marker pen or other suitable method before dismantling.

2.2 Drive end (DE) cover (A) to motor body (B).

2.3 Non-drive end cover (D) to motor body (C).

2.4 Enclosing Cover (18) to non-drive end (NDE) cover (17).

2.5 Prior to resolver dismantling, mark outside end faces of resolver stator (4) and resolver rotor (3)

3 DISMANTLING THE MOTOR

3.1 Remove 4 M4 socket screws from N.D.E. enclosing cover (18), remove the end cover and the gasket.

3.2 Remove 8 screws (21) from D.E. cover (12).

3.3 For Sagem resolver this must be removed prior to dismantling of the motor, proceed as per instructions for tacho removal, for any other manufacturer check with SEM for instructions.

3.4 Withdraw D.E. cover with complete attached assembly of rotor (1), bearings (10 & 8), resolver rotor (3) and spacer (5). Remove circlip (11) and press out rotor shaft to separate from D.E. housing. Remove circlip (9) and remove bearing from D.E. housing. To remove resolver rotor (3) use bearing extractor tool behind the shoulder on spacer (5); the bearing can then be withdrawn. Handle the resolver assembly with great care at all times.

3.5 Before removing N.D.E., go through the disconnection sequence:

3.6 **Disconnection sequence.** PIN REMOVAL TOOL REQUIRED – available from SEM Ltd. Both connectors (23 & 27) must be removed before N.D.E. cover can be removed. Take out 4 screws, pull the socket forward to allow access to connector pins. Withdraw the connector pins using the pin removal tool. Pull wires through from feedback connector (23) to clear screw access, remove 4 screws (20) from N.D.E. cover. Withdraw the cover carefully to avoid damage to wiring.

3.7 **Removal of resolver.** Important: At all stages of removal and reassembly, the resolver unit must be handled with care. Unscrew (36) and release resolver body (4) complete. At this point the resolver rotor (3) is free and will drop out of the resolver body unless held in place by hand. Remove the resolver and store in a safe place until re-assembly.

3.8 **Removal of D.E. cover – Brake Models.** Remove 8 cover screws (21) then 3 screws (19) holding brake assembly. This allows cover to be removed, leaving the brake and bearing on the shaft and exposing the leads to the brake. Disconnect these leads and remove complete rotor assembly as Section 3.4. Pull the bearing off the shaft, leaving brake free to be removed. When this sequence is complete, continue as Section 3.4 above.

4 RE-ASSEMBLY OF THE MOTOR

To fit N.D.E. cover to body. Note: new circlips, oil seals and bearings must be fitted on the re-assembly as standard procedure.

4.1 Feed the thermal overload leads through the hole in the N.D.E. cover, feed the earth lead through the hole in the body and fit 4 cap head screws.

4.2 Fit the resolver to the N.D.E. cover with 3 screws and clamping washers (metal shield outwards), feed both resolver and thermal overload leads through the hole on the left of the N.D.E. cover.

4.3 Fit 2 connector elbows with cap screws and gaskets, bringing out The leads at the same time. Press the pins firmly into the back of the connectors until they click into place. Position the connectors and gaskets and tighten down with screws and washers.

4.4 Fit O-ring, bearing and circlip to D.E. cover, slide rotor into cover/bearing assembly. Slide bearing onto N.D.E. of shaft.

4.5 Supporting the inner race of the bearing, press both bearings into place. Fit spacer and tolerance ring to N.D.E. Fit circlip at D.E.

4.6 Carefully stand motor upright (with N.D.E. down). Locate the wave washer in the N.D.E. housing, lower the rotor/cover assembly very carefully into the body and screw the D.E. cover to the body.

4.7 Support and press into position (resolver rotor). Fit a new tolerance ring (2). Fit brake, carefully press rotor into brake (ensuring that teeth line up correctly). Fit rotor to body as above, but connect and isolate 2 brake leads before pushing into place.

5 RESETTING THE RESOLVER.

5.1 This only applies to a standard resolver supplied by SEM with the standard setting. For any other resolver, refer to the drive manufacturer.

5.2 For these procedures it is necessary to make connections and links to feedback connector pins. To avoid damage to these pins, it is advisable to make such connections and links via a suitable separate test socket which mates with the feedback connector multi-pin plug (27) and which has short leads connected to its sockets. Alternatively appropriate pins can be made available for connections and links by withdrawing them from plug (27) as in Section 3.6 “Disconnection”.

5.3 If a brake is used, it must be temporarily held off during this operation by applying a 24V dc supply across the brake terminals.

5.4 Undo 4 screws (20) and pull back the enclosing cover (18) to give access to the resolver. With the above test plug connected to the feedback connector, link pins R1 to S3 & pins R2 to S2. Connect a signal generator (approx 5V 6kHz) between pins R1 and R2. Connect an AC voltmeter between pins S1 and R2.

5.5 At the power connector, link motor phase pins V and W and then connect a low voltage dc supply to motor phases at power connector pins U (+ve) and V+W (-ve). Adjust this voltage to give between 25% and 100% of motor rated current thereby causing the motor to turn to a preferred position.

5.6 Slacken the 3 screws holding the resolver stator and then rotate it until the voltmeter gives a maximum reading. Reconnect the AC voltmeter to pins S4 and R2. Make a small final adjustment of the resolver stator to get a minimum reading. Retighten the screws, disconnect the test socket, the supplies, the voltmeter and links, let the brake (if used) be re-applied.

5.7 Attach the protective shield (if fitted) to the resolver and fix the enclosing cover (18) to the NDE cover in accordance with marks made in operation 2.2.

6 ELECTRICAL TESTS NECESSARY BEFORE CONNECTING MOTOR TO AMPLIFIER.

6.1 Measure motor stator winding resistances U-V, V-W, W-U. These must be equal to within 3%.

6.2 Check dielectric strength by flash test at 1000 Vac from:

- a Phase U (power connector pin) U to motor body.
- b Phase U to thermal sensor (feedback connector pins Thermal Sensor + and Thermal Sensor -).
- c Phase U to brake connections (power connector pins B+ & B-).

If flash test is not possible then check that insulation resistance is greater than 1megaohm.

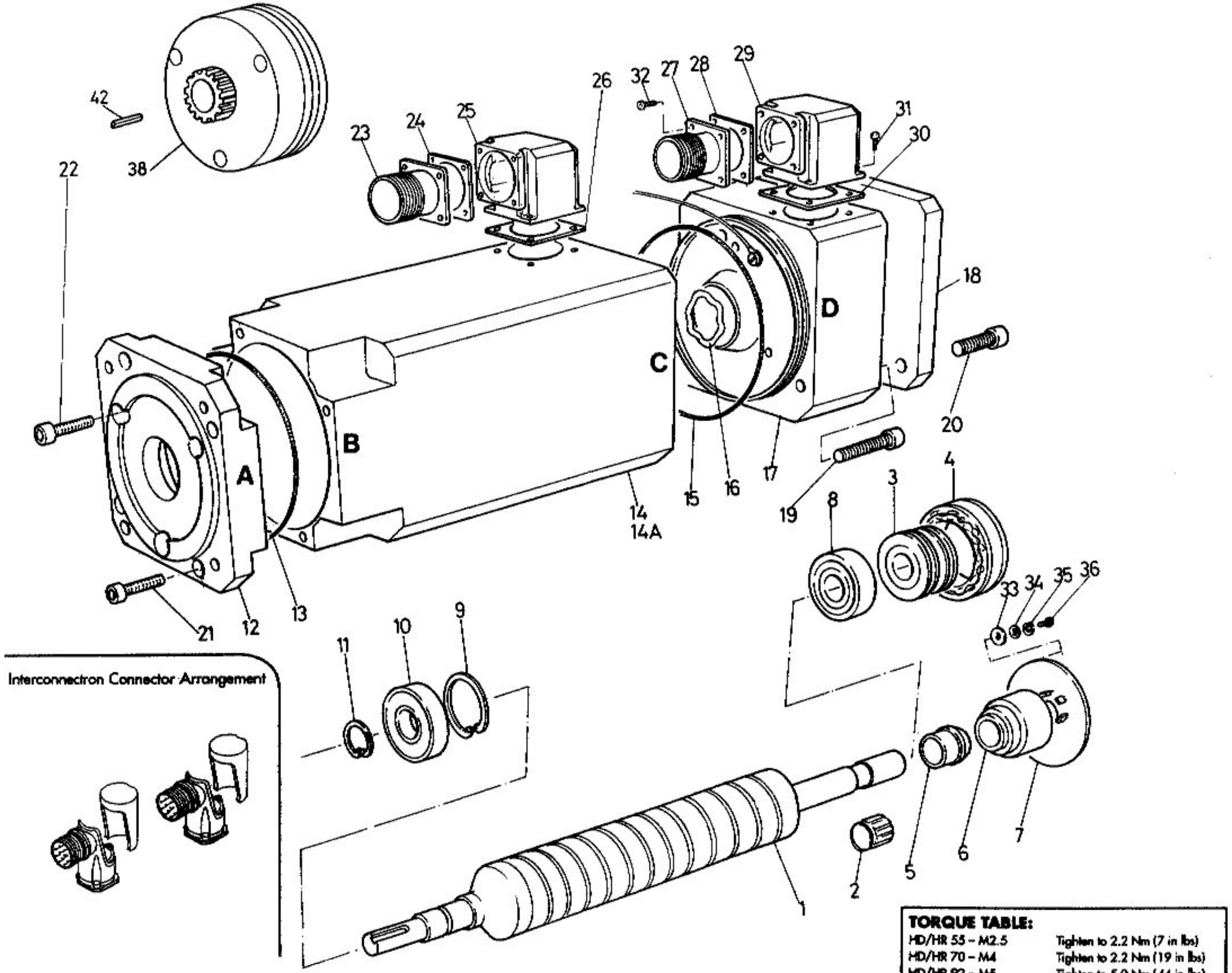
6.3 Check dielectric strength by flash test at 500Vac or with a 500Vdc supply from motor body to:

- d Brake connections (power connector pins B+ and B-)
- e Thermal sensor (feedback connector pins Thermal Sensor + and Thermal Sensor -)
- f Resolver (feedback connector pins R2 and S1.

6.4 If flash test is not possible then check that insulation resistance is greater than 1megaohm.

HD/HR70 parts list

ITEM NO.	DESCRIPTION
1	Rotor Assembly
2	Tolerance Ring
3	Resolver Rotor
4	Resolver Body
5	Spacer (Non tacho motors only)
6	Tachogenerator Rotor Assembly
7	P.C. B. Assembly
8	N.D.E. Bearing
9	Bearing Retaining Circlip
10	D.E. Bearing
11	Bearing Retaining Circlip
12	D.E. Cover
13	D.E. ‘O’ Ring
14	Motor Body
14a	Long Motor Body for Brake Motor
15	N.D.E. ‘O’ Ring
16	Wave Washer
17	Non Drive End Housing
18	N.D.E. Enclosing Cover
19	N.D.E. Housing Fixing Screw
20	N.D.E. Cover Fixing Screw
21	D.E. Cover Fixing Screw
22	Fixing Screw: Brake
23	M.S. Connector: Power
24	Gasket
25	Connector Housing
26	Gasket
27	MS Connector: Feedback
28	Gasket
29	Connector Housing
30	Gasket
31	Fixing Screw: Cap-head
32	Fixing Screw: Cheese-head
33	Plain Washer M4
34	Plain Washer M3
35	Single-turn Coil Spring Washer
36	Fixing Screw
37	Brake Key (Optional)
38	Brake (Optional)



TORQUE TABLE:

HD/HR 55 – M2.5	Tighten to 2.2 Nm (7 in lbs)
HD/HR 70 – M4	Tighten to 2.2 Nm (19 in lbs)
HD/HR 92 – M5	Tighten to 5.0 Nm (44 in lbs)
HD/HR 115 – M5	Tighten to 5.0 Nm (44 in lbs)
HD/HR 142 – M6	Tighten to 8.0 Nm (71 in lbs)
BMR 190/HD190 – M10	Tighten to 25.0 Nm (221 in lbs)

SEM controlled motor technology

SEM Limited, Faraday Way, Orpington, Kent BR5 3QT England
Telephone: +44 (0)1689 884700 • Fax: +44 (0) 1689 884884
E-mail: info@sem.co.uk • Internet http://www.sem.co.uk

HD/HR92

servicing instructions

1 GENERAL

1.1 Before starting work on the motor, these servicing instructions should be read and fully understood.

1.2 Servicing of SEM motors must be done only by suitably trained and qualified personnel, and only after such motors have been electrically isolated and removed from their mechanical drives.

1.3 The jaws of any vice or clamp must be suitably protected when used to grip any part of the motor.

1.4 When separating the motor end covers from the motor body, care must be taken to avoid damage to their mating surfaces.

1.5 NOTE. There are strong magnetic forces between the stator and the rotor of all SEM servomotors. Fingers should be kept clear of the gaps between the stator and end covers during assembly and disassembly of the rotor.

1.6 Dismantled components awaiting reassembly, should be kept in a safe, clean and dry location.

Various types of encoder are used, involving different procedures for dismantling, reassembly, connection, setting up and testing. Contact SEM with regard to relevant servicing procedures for the particular type of encoder involved.

2 MARKING

2.1 The following relationships must be marked with a marker pen or other suitable method before dismantling.

2.2 Drive end (DE) cover (A) to motor body (B).

2.3 Non-drive end cover (D) to motor body (C).

2.4 Enclosing Cover (17) to non-drive end (NDE) cover (11).

2.5 Prior to resolver dismantling, mark outside end faces of resolver stator (4) and resolver rotor (3)

3 DISMANTLING THE MOTOR

3.1 Remove 4 M4 socket screws from NDE enclosing cover (17), remove the end cover and the O Ring.

3.2 Grip the drive end of the rotor shaft (1) in a suitably protected vice and loosen the nut (2). Leave this nut finger tight until the resolver is required to be removed. (Note that a special tool is required, contact SEM for details). Remove the unit from the vice at this point.

3.3 **Disconnection sequence, (MS Connectors option).** Remove 8 fixing screws and pull M.S. plugs (29 & 30) clear of non drive end housing sufficiently to allow access to wires for unsoldering of existing connectors. When the wires are unsoldered the M.S. connectors can be removed. (It is important to note all connections prior to unsoldering).

3.4 **Disconnection sequence, (Terminal Box assembly option).** Remove terminal box screws (27) lid, (21) and gasket (28). Unsolder all connections from M.S. Connector (30) and release 3 motor leads and 2 brake leads from terminal block (23). To remove the terminal box (20) from the non drive end housing, remove screw and nut (25 & 26).

3.5 **Removal of Resolver. Important.** At all stages of removal and reassembly, the resolver unit must be handled with care. (See Para 14). Unscrew (7 & 8) and release resolver body (4) complete. Remove nut (2), noting that at this point the resolver rotor (3) is free, and will drop out of the resolver body unless held in place by hand. Remove the resolver and store in a safe place until re-assembly.

3.6 **Removal of Drive End Cover, (Non Brake models).** (do not lever between body and end covers under any circumstance) Remove 4, M5 screws (36). Do not attempt to separate the N.D.E. housing from the motor body at this stage. Remove 4 screws (35) and separate the drive end cover from the motor body (10) and rotor shaft (1). Remove and discard the oil seal (19) and the O-ring (13) (note that the oil seal must be pressed out using a suitable tool. The rotor assembly is now free to be removed, via the non-drive end, but it is still attached to the N.D.E. cover by N.D.E. bearing (6).

3.7 **Removal of N.D.E. Housing. TAKE CARE!** The rotor itself is covered by a protective tape, and before any attempt is made at further withdrawal, the rotor must be properly supported and eased through the motor body so that the tape is not damaged in any way. This is most important. To remove rotor from N.D.E. cover, remove circlips (14) from N.D.E. cover to release N.D.E. bearing (6). Support the N.D.E. cover and rotor assembly in such a way as to allow the rotor to be gently tapped or pushed out of the housing. (Only use a hide mallet it tapping out is necessary).

3.8 **Removal of D.E. Cover (Brake Models).** Remove 3 screws which hold brake assembly to D.E. housing, then follow instructions as for non-brake model, (section 3.8). When drive end cover is removed, the brake assembly (38) and bearing (15) are left on the rotor shaft (1).

After removing circlip (41) the bearing itself can only be removed by use of a suitable tool. This will leave the brake assembly free to be removed from the rotor shaft after disconnection of the relevant 'spade' connectors. Then follow instructions as applicable to nonbrake motor (section 3.9).

4 RE-ASSEMBLY OF MOTOR

4.1 Note: New circlips, bearings oil seals and O-ring must be fitted on reassembly as standard procedure. Also ensure that all marks made in section 2 are in alignment as applicable. Fit bearing (6) into N.D.E. housing. Fit D.E. Bearing (15) onto rotor (1). Supporting inner race of N.D.E. bearing, press rotor assembly back into N.D.E. housing, fit circlip (40). Fit new O-ring (13).

4.2 Carefully re-insert assembled rotor and N.D.E. housing through the motor body at the same time feeding connection wires through the crescent shape hole in the N.D.E. housing, taking care not to trap wires or to damage the protective tape on the rotor when completing this assembly. Tighten screws, using correct torque (see torque table). Refit brake when fitted and fit bearing (15) (reconnect 'spade' connectors). Refit drive end housing (12) with wave washer 2, (16) and O-ring (13) in position. Refit screws and tighten to correct torque (see torque table). Fit oil seal (19).

4.3 Refit Resolver. Slide Resolver body into non drive end of rotor shaft and screw into N.D. E. housing using screw (7) and clamps (8). Refit resolver rotor (3), fit new nut (2) and tighten to correct torque (see torque table), gripping drive end of rotor shah in a suitably protected vice (as para 3). Re-assemble M.S. connectors or terminal box assembly as applicable, in reverse sequence to paras 3.3 & 3.4.

5 RESETTING THE RESOLVER.

5.1 This only applies to a standard resolver supplied by SEM with the standard setting. For any other resolver, refer to the drive manufacturer.

5.2 For these procedures it is necessary to make connections and links to feedback connector pins. To avoid damage to these pins, it is advisable to make such connections and links via a suitable separate test socket which mates with the feedback connector multi-pin plug (30) and which has short leads connected to its sockets. Alternatively appropriate pins can be made available for connections and links by withdrawing them from plug (30) as in Section 3.3 and 3.4 "Disconnection".

5.3 If a brake is used, it must be temporarily held off during this operation by applying a 24V dc supply across the brake terminals.

5.4 Undo 4 screws (37) and pull back the enclosing cover (17) to give access to the resolver. With the above test plug connected to the feedback connector, link pins R1 to S3 & pins R2 to S2. Connect a signal generator (approx 5V 6kHz) between pins R1 and R2. Connect an AC voltmeter between pins S1 and R2.

5.5 At the power connector, link motor phase pins V and W and then connect a low voltage dc supply to motor phases at power connector pins U (+ve) and V+W (-ve). Adjust this voltage to give between 25% and 100% of motor rated current thereby causing the motor to turn to a preferred position.

5.6 Slacken the 3 screws (7) holding the resolver stator and then rotate it until the voltmeter gives a maximum reading. Reconnect the AC voltmeter to pins S4 and R2. Make a small final adjustment of the resolver stator to get a minimum reading. Retighten the screws, disconnect the test socket, the supplies, the voltmeter and links, let the brake (if used) be re-applied.

5.7 Attach the protective shield (if fitted) to the resolver and fix the enclosing cover (17) to the NDE cover in accordance with marks made in operation 2.4.

6 ELECTRICAL TESTS NECESSARY BEFORE CONNECTING MOTOR TO AMPLIFIER.

6.1 Measure motor stator winding resistances U-V, V-W, W-U. These must be equal to within 3%.

6.2 Check dielectric strength by flash test at 1000 Vac from:

a Phase U (power connector pin) U to motor body.

b Phase U to thermal sensor (feedback connector pins Thermal Sensor + and Thermal Sensor -).

c Phase U to brake connections (power connector pins B+ & B-).

If flash test is not possible then check that insulation resistance is greater than 1megaohm.

6.3 Check dielectric strength by flash test at 500Vac or with a 500Vdc supply from motor body to:

d Brake connections (power connector pins B+ and B-)

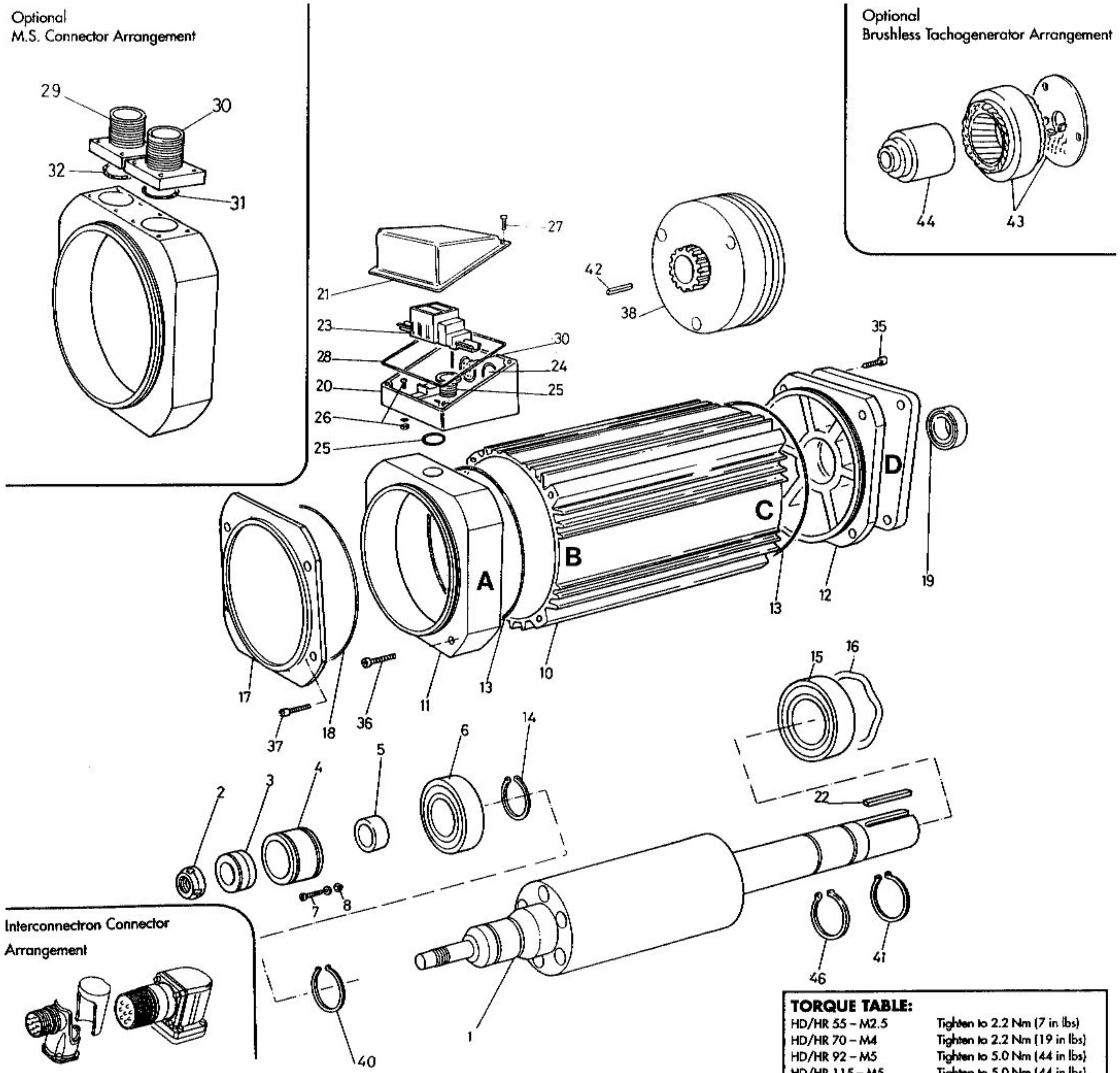
e Thermal sensor (feedback connector pins Thermal Sensor + and Thermal Sensor -)

f Resolver (feedback connector pins R2 and S1.

6.4 If flash test is not possible then check that insulation resistance is greater than 1megaohm.

HD/HR92 parts list

ITEM NO.	DESCRIPTION
1	Rotor Assembly
2	Clamp Nut
3	Resolver Rotor
4	Resolver Body
5	Spacer (Resolver only)
6	Bearing Non Drive End
7	Resolver Body Fixing Screws
8	Resolver Body Synchro Clamp
10	Motor Body
11	Non Drive End Housing
12	Drive End Cover
13	'O' Ring
14	Bearing Retaining Circlip
15	Bearing Drive End
16	Wave Washer
17	Non Drive End Enclosing Cover
18	'O' Ring
19	Oilseal
20	Terminal Box
21	Terminal Box Lid
22	Key
23	Terminal Block Assembly
24	Blanking Plug
25	Conduit Nipple and 'O' Ring
26	Earth Lead Screw and Clamp
27	Terminal Box Lid Fixing Screws
28	Terminal Box Lid Gasket
29	Motor M.S. Connector 7 Pin (Optional)
30	M.S. Connector Feedback 17 Pin
31	'O' Ring
32	'O' Ring
34	Spacer Plate Gasket (Optional)
35	Fixing Screw Drive End Cover
36	Fixing Screw Non Drive End Housing
37	Fixing Screw Non D.E. Enclosing Cover
38	Brake (Optional)
39	Circlip (Brake) (Optional)
40	Circlip (Non Drive End)
41	Circlip (Drive End) (Optional)
42	Brake Key (Optional)
43	Tacho Stator and P.C.B. Assy (Optional)
44	Tacho Rotor Assy (Optional)



TORQUE TABLE:

HD/HR 55 – M2.5	Tighten to 2.2 Nm (7 in lbs)
HD/HR 70 – M4	Tighten to 2.2 Nm (19 in lbs)
HD/HR 92 – M5	Tighten to 5.0 Nm (44 in lbs)
HD/HR 115 – M5	Tighten to 5.0 Nm (44 in lbs)
HD/HR 142 – M6	Tighten to 8.0 Nm (71 in lbs)
BMR 190/HD190 – M10	Tighten to 25.0 Nm (221 in lbs)

SEM controlled motor technology

SEM Limited, Faraday Way, Orpington, Kent BR5 3QT England
Telephone: +44 (0)1689 884700 • Fax: +44 (0) 1689 884884
E-mail: info@sem.co.uk • Internet http://www.sem.co.uk

HD/HR115

servicing instructions

1 GENERAL

1.1 Before starting work on the motor, these servicing instructions should be read and fully understood.

1.2 Servicing of SEM motors must be done only by suitably trained and qualified personnel, and only after such motors have been electrically isolated and removed from their mechanical drives.

1.3 The jaws of any vice or clamp must be suitably protected when used to grip any part of the motor.

1.4 When separating the motor end covers from the motor body, care must be taken to avoid damage to their mating surfaces.

1.5 NOTE. There are strong magnetic forces between the stator and the rotor of all SEM servomotors. Fingers should be kept clear of the gaps between the stator and end covers during assembly and disassembly of the rotor.

1.6 Dismantled components awaiting reassembly, should be kept in a safe, clean and dry location.

Various types of encoder are used, involving different procedures for dismantling, reassembly, connection, setting up and testing. Contact SEM with regard to relevant servicing procedures for the particular type of encoder involved.

2 MARKING

2.1 The following relationships must be marked with a marker pen or other suitable method before dismantling.

2.2 Drive end (DE) cover (A) to motor body (B).

2.3 Non-drive end cover (D) to motor body (C).

2.4 Enclosing Cover (17) to non-drive end (NDE) cover (11).

2.5 Prior to resolver dismantling, mark outside end faces of resolver stator (4) and resolver rotor (3)

3 DISMANTLING THE MOTOR

3.1 Remove M5 socket screws from NDE enclosing cover (17), remove the end cover and the O Ring.

3.2 Grip the drive end of the rotor shaft (11) in a suitably protected vice and loosen the nut (12). Leave this nut finger tight until the resolver is required to be removed. (Note that a special tool is required, available from SEM). Remove the unit from the vice at this point.

3.3 **Disconnection sequence, (MS Connectors option).** Remove 8 fixing screws and pull M.S. plugs (29 & 30) clear of non drive end housing sufficiently to allow access to wires for unsoldering of existing connectors. When the wires are unsoldered the M.S. connectors can be removed. (It is important to note all connections prior to unsoldering).

3.4 **Disconnection sequence, (Terminal Box assembly option).** Remove terminal box screws (27) lid, (21) and gasket (28). Unsolder all connections from M.S. Connector (30) and release 3 motor leads and 2 brake leads from terminal block (23). To remove the terminal box (20) from the non drive end housing, remove screw and nut (25 & 26).

3.5 **Removal of Resolver. Important.** At all stages of removal and re-assembly, the resolver unit must be handled with care. (See Para 14). Unscrew (7 & 8) and release resolver body (4) complete. Remove nut (2), noting that at this point the resolver rotor (3) is free, and will drop out of the resolver body unless held in place by hand. Remove the resolver and store in a safe place until re-assembly.

3.6 **Removal of Drive End Cover, (Non Brake models).** (Do not lever between body and end covers under any circumstance). Remove 4, M5 socket screws (36). Do not attempt to separate the N.D.E. housing from the motor body at this stage. Remove 4 screws (35) and separate the drive end cover from the motor body (10) and rotor shaft (1). Remove and discard the oil seal (19) and the O-ring (13) (note that the oil seal must be pressed out using a suitable tool. The rotor assembly is now free to be removed, via the non-drive end, but it is still attached to the N.D.E. cover by N.D.E. bearing (6).

3.7 **Removal of N.D.E. Housing. TAKE CARE!** The rotor itself is covered by a protective tape, and before any attempt is made at further withdrawal, the rotor must be properly supported and eased through the motor body so that the tape is not damaged in any way. This is most important. To remove rotor from N.D.E. cover, remove circlips (14) from N.D.E. cover to release N.D.E. bearing (6). Support the N.D.E. cover and rotor assembly in such a way as to allow the rotor to be gently tapped or pushed out of the housing. (Only use a hide mallet if tapping out is necessary).

3.8 **Removal of D.E. Cover (Brake Models)**. Remove 6 screws which hold brake assembly to D.E. housing, then follow instructions as for non-brake model, (section 3.7). When drive end cover is removed, the brake assembly (38) and bearing (15) are left on the rotor shaft (1).

3.9 After removing circlip (41) the bearing itself can only be removed by use of a suitable tool. This will leave the brake assembly free to be removed from the rotor shaft after disconnection of the relevant 'spade' connectors. Then follow instructions as applicable to nonbrake motor (section 3.7).

4 RE-ASSEMBLY OF MOTOR

4.1 Note: New circlips, bearings, oil seals and O-ring must be fitted on reassembly as standard procedure. Also ensure that all marks made in section 2 are in alignment as applicable. Fit bearing (6) into N.D.E. housing. Fit D.E. Bearing (15) onto rotor (1). Supporting inner race of N.D.E. bearing, press rotor assembly back into N.D.E. housing, fit circlip (40). Fit new O-ring (13).

4.2 Carefully re-insert assembled rotor and N.D.E. housing through the motor body at the same time feeding connection wires through the crescent shape hole in the N.D.E. housing, taking care not to trap wires or to damage the protective tape on the rotor when completing this assembly. Tighten screws, using correct torque (see torque table). Refit brake when fitted and fit bearing (15) (reconnect 'spade' connectors). Refit drive end housing (12) with wave washer (16) and O-ring (13) in position. Refit screws and tighten to correct torque (see torque table). Fit oil seal (19).

4.3 Refit Resolver. Slide Resolver body into non drive end of rotor shah and screw into N.D. E. housing using screw (7) and clamps (8).

4.4 Refit resolver rotor (3), refit nut (2) and tighten to correct torque (see torque table), gripping drive end of rotor shaft in a suitably protected vice (as section 3.2). Re-assemble M.S. connectors or terminal box assembly as applicable, in reverse sequence to sections 3.3 & 3.4.

5 RESETTING THE RESOLVER.

5.1 This only applies to a standard resolver supplied by SEM with the standard setting. For any other resolver, refer to the drive manufacturer.

5.2 For these procedures it is necessary to make connections and links to feedback connector pins. To avoid damage to these pins, it is advisable to make such connections and links via a suitable separate test socket which mates with the feedback connector multi-pin plug (30) and which has short leads connected to its sockets. Alternatively appropriate pins can be made available for connections and links by withdrawing them from plug (30) as in Section 3.3 & 3.4 "Disconnection".

5.3 If a brake is used, it must be temporarily held off during this operation by applying a 24V dc supply across the brake terminals.

5.4 Undo 4 screws (37) and pull back the enclosing cover (17) to give access to the resolver. With the above test plug connected to the feedback connector, link pins R1 to S3 & pins R2 to S2. Connect a signal generator (approx 5V 6kHz) between pins R1 and R2. Connect an AC voltmeter between pins S1 and R2.

5.5 At the power connector, link motor phase pins V and W and then connect a low voltage dc supply to motor phases at power connector pins U (+ve) and V+W (-ve). Adjust this voltage to give between 25% and 100% of motor rated current thereby causing the motor to turn to a preferred position.

5.6 Slacken the 3 screws holding the resolver stator and then rotate it until the voltmeter gives a maximum reading. Reconnect the AC voltmeter to pins S4 and R2. Make a small final adjustment of the resolver stator to get a minimum reading. Retighten the screws, disconnect the test socket, the supplies, the voltmeter and links, let the brake (if used) be re-applied.

5.7 Attach the protective shield (if fitted) to the resolver and fix the enclosing cover (17) to the NDE cover in accordance with marks made in operation 2.4.

6 ELECTRICAL TESTS NECESSARY BEFORE CONNECTING MOTOR TO AMPLIFIER.

6.1 Measure motor stator winding resistances U-V, V-W, W-U. These must be equal to within 3%.

6.2 Check dielectric strength by flash test at 1000 Vac from:

a Phase U (power connector pin) U to motor body.

b Phase U to thermal sensor (feedback connector pins Thermal Sensor + and Thermal Sensor -).

c Phase U to brake connections (power connector pins B+ & B-).

If flash test is not possible then check that insulation resistance is greater than 1megaohm.

6.3 Check dielectric strength by flash test at 500Vac or with a 500Vdc supply from motor body to:

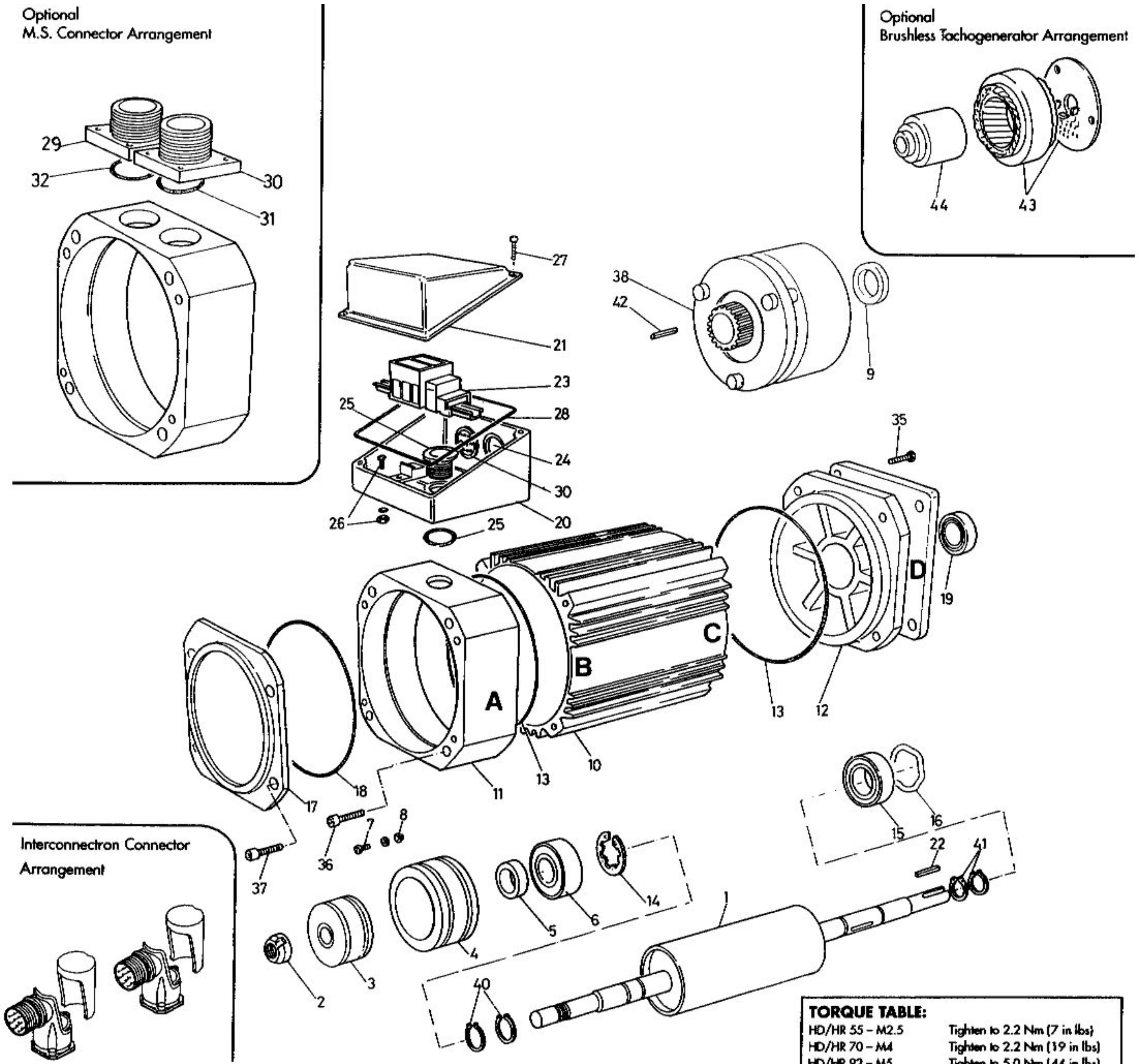
d Brake connections (power connector pins B+ and B-)

e Thermal sensor (feedback connector pins Thermal Sensor + and Thermal Sensor -)

f Resolver (feedback connector pins R2 and S1.

g If flash test is not possible then check that insulation resistance is greater than 1megaohm.

SEM Limited, Faraday Way, Orpington, Kent BR5 3QT England
Telephone: +44 (0)1689 884700 • Fax: +44 (0) 1689 884884
E-mail: info@sem.co.uk • Internet http://www.sem.co.uk



TORQUE TABLE:

HD/HR 55 – M2.5	Tighten to 2.2 Nm (7 in lbs)
HD/HR 70 – M4	Tighten to 2.2 Nm (19 in lbs)
HD/HR 92 – M5	Tighten to 5.0 Nm (44 in lbs)
HD/HR 115 – M5	Tighten to 5.0 Nm (44 in lbs)
HD/HR 142 – M6	Tighten to 8.0 Nm (71 in lbs)
BMR 190/HD190 – M10	Tighten to 25.0 Nm (221 in lbs)

HD/HR115 parts list

ITEM NO.	DESCRIPTION
1	Rotor Assembly
2	Clamp Nut
3	Resolver Rotor
4	Resolver Body
5	Spacer {Resolver only)
6	Bearing Non Drive End
7	Resolver Body Fixing Screws
8	Resolver Body Synchro Clamp
9	Spacer (Optional)
10	Motor Body
11	Non Drive End Housing
12	Drive End Cover
13	‘O’ Ring
14	Circlip
15	Bearing Drive End
16	Wave Washer
17	Non Drive End Enclosing Cover
18	‘O’ Ring
19	Oilseal
20	Terminal Box
21	Terminal Box Lid
22	Key
23	Terminal Block Assembly
24	Blanking Plug
25	Conduit Nipple and ‘O’ Ring
26	Earth Lead Screw and Clamp
27	Terminal Box Lid Fixing Screw
28	Terminal Box Lid Gasket
29	Motor M.S. Connector 7 Pin (Optional)
30	Feedback M.S. Connector 17 Pin
31	‘O’Ring
32	‘O’Ring
34	Spacer Plate Gasket (Optional)
35	Fixing Screw (Drive End)
36	Fixing Screw (Non Drive End Housing)
37	Fixing Screw (Non Drive End Enclosing Cover)
38	Brake (Optional)
40	Circlip (Non Drive End)
41	Circlip (Drive End)
42	Brake Key (Optional)
43	Tacho Stator and P.C.B. Assembly (Optional)
44	Tacho Rotor Assy (Optional)
45	Brake Circlip (Optional)

SEM controlled motor technology
SEM Limited, Faraday Way, Orpington, Kent BR5 3QT England
Telephone: +44 (0)1689 884700 • Fax: +44 (0) 1689 884884
E-mail: info@sem.co.uk • Internet http://www.sem.co.uk

HD/HR142

servicing instructions

1 GENERAL

1.1 Before starting work on the motor, these servicing instructions should be read and fully understood.

1.2 Servicing of SEM motors must be done only by suitably trained and qualified personnel, and only after such motors have been electrically isolated and removed from their mechanical drives.

1.3 The jaws of any vice or clamp must be suitably protected when used to grip any part of the motor.

1.4 When separating the motor end covers from the motor body, care must be taken to avoid damage to their mating surfaces.

1.5 NOTE. There are strong magnetic forces between the stator and the rotor of all SEM servomotors. Fingers should be kept clear of the gaps between the stator and end covers during assembly and disassembly of the rotor.

1.6 Dismantled components awaiting reassembly, should be kept in a safe, clean and dry location.

Various types of encoder are used, involving different procedures for dismantling, reassembly, connection, setting up and testing. Contact SEM with regard to relevant servicing procedures for the particular type of encoder involved.

2 MARKING

2.1 The following relationships must be marked with a marker pen or other suitable method before dismantling.

2.2 Drive end (DE) cover (A) to motor body (B).

2.3 Non-drive end cover (D) to motor body (C).

2.4 Enclosing Cover to non-drive end (NDE) cover.

2.5 Prior to resolver dismantling, mark outside end faces of resolver stator (4) and resolver rotor (3)

3 DISMANTLING THE MOTOR

3.1 Remove M5 socket screws from NDE enclosing cover (17), remove the end cover and the O-ring.

3.2 Grip the drive end of the rotor shaft (1) in a suitably protected vice and loosen the nut (2). Leave this nut finger tight until the resolver is required to be removed. (Note that a special tool is required, available from SEM). Remove the unit from the vice at this point.

3.3 **Disconnection sequence, (MS Connectors option).** Remove 8 fixing screws and pull M.S. plugs (29 & 30) clear of non drive end housing sufficiently to allow access to wires for unsoldering of existing connectors. When the wires are unsoldered, the M.S. connectors can be removed. (It is important to note all connections prior to unsoldering).

3.4 **Disconnection sequence, (Terminal Box assembly option).** Remove terminal box screws (27) lid, (21) and gasket (28). Unsolder all connections from M.S. Connector (30) and release 3 motor leads and 2 brake leads from terminal block (23). To remove the terminal box (20) from the non drive end housing, remove screw and nut (25 & 26).

3.5 **Removal of Resolver. Important.** At all stages of removal and reassembly, the resolver unit must be handled with care. (See Para 14). Unscrew (7 & 8) and release resolver body (4) complete. Remove nut (2), noting that at this point the resolver rotor (3) is free, and will drop out of the resolver body unless held in place by hand. Remove the resolver and store in a safe place until re-assembly.

3.6 **Removal of Drive End Cover, (Non Brake models).** (do not lever between body and end covers under any circumstance). Remove 4, M8 socket screws (36). Do not attempt to separate the N.D.E. housing from the motor body at this stage. Remove 4 screws (35) and separate the drive end cover from the motor body (10) and rotor shaft (1). Remove and discard the oil seal (19) and the O-ring (13) (note that the oil seal must be pressed out using a suitable tool. The rotor assembly is now free to be removed, via the non-drive end, but it is still attached to the N.D.E. cover by N.D.E. bearing (6).

3.7 **Removal of N.D.E. Housing. TAKE CARE!** The rotor itself is covered by a protective tape, and before any attempt is made at further withdrawal, the rotor must be properly supported and eased through the motor body so that the tape is not damaged in any way. This is most important. To remove rotor from N.D.E. cover, remove circlips (14) from N.D.E. cover to release N.D.E. bearing (6). Support the N.D.E. cover and rotor assembly in such a way as to allow the rotor to be gently tapped or pushed out of the housing. (Only use a hide mallet if tapping out is necessary).

3.8 **Removal of D.E. Cover (Brake Models).** Remove 6 screws which hold brake assembly to D.E. housing, then follow instructions as for nn-brake model, (section 3.6). When drive end cover is removed, the brake assembly (38) and bearing (15) are left on the rotor shaft (I). After removing circlip (41) the bearing itself can only be removed by use of a suitable tool. This will leave the brake assembly free to be removed from the rotor shaft after disconnection of the relevant 'spade' connectors. Then follow instructions as applicable to nonbrake motor (section 3.7).

4 RE-ASSEMBLY OF MOTOR

4.1 Note: New circlips, bearings, oil seals and O-ring must be fitted on reassembly as standard procedure. Also ensure that all marks made under Para. 1 (a,b,c,) are in alignment as applicable. Fit bearing 16) into N.D.E. housing. Fit D.E. Bearing 115) onto rotor (1). Supporting inner race of N.D.E. bearing, press rotor assembly back into N.D.E. housing, fit circlip (40). Fit new O-ring I13). 11. Carefully re-insert assembled rotor and N.D.E. housing through the motor body at the same time feeding connection wires through the crescent shape hole in the N.D.E. housing, taking care not to trap wires or to damage the protective tape on the rotor when completing this assembly. Tighten screws, using correct torque (see torque table). Refit brake when fitted and fit bearing (15) (reconnect 'spade' connectors). Refit drive end housing (12) with wave washer (16) and O-ring (13) in position. Refit screws and tighten to correct torque (see torque table). Fit oil seal (19).

4.2 Refit Resolver. Slide Resolver body into non drive end of rotor shaft and screw into N.D. E. housing using screw (7) and clamps (8). Refit resolver rotor (3), refit nut (2) and tighten to correct torque (see torque table), gripping drive end of rotor shaft in a suitably protected vice (as para 3). Re-assemble M.S. connectors or terminal box assembly as applicable, in reverse sequence to paras 4 & 5.

5 RESETTING THE RESOLVER.

5.1 This only applies to a standard resolver supplied by SEM with the standard setting. For any other resolver, refer to the drive manufacturer.

5.2 For these procedures it is necessary to make connections and links to feedback connector pins. To avoid damage to these pins, it is advisable to make such connections and links via a suitable separate test socket which mates with the feedback connector multi-pin plug (30) and which has short leads connected to its sockets. Alternatively appropriate pins can be made available for connections and links by withdrawing them from plug (30) as in Section 3.2 & 3.3 "Disconnection".

5.3 If a brake is used, it must be temporarily held off during this operation by applying a 24V dc supply across the brake terminals.

5.4 Undo 4 screws (37) and pull back the enclosing cover (17) to give access to the resolver. With the above test plug connected to the feedback connector, link pins R1 to S3 & pins R2 to S2. Connect a signal generator (approx 5V 6kHz) between pins R1 and R2. Connect an AC voltmeter between pins S1 and R2.

5.5 At the power connector, link motor phase pins V and W and then connect a low voltage dc supply to motor phases at power connector pins U (+ve) and V+W (-ve). Adjust this voltage to give between 25% and 100% of motor rated current thereby causing the motor to turn to a preferred position.

5.6 Slacken the 3 screws (7) holding the resolver stator and then rotate it until the voltmeter gives a maximum reading. Reconnect the AC voltmeter to pins S4 and R2. Make a small final adjustment of the resolver stator to get a minimum reading. Retighten the screws, disconnect the test socket, the supplies, the voltmeter and links, let the brake (if used) be re-applied.

5.7 Attach the protective shield (if itted) to the resolver and fix the enclosing cover (17) to the NDE cover in accordance with marks made in operation 2.4.

6 ELECTRICAL TESTS NECESSARY BEFORE CONNECTING MOTOR TO AMPLIFIER.

6.1 Measure motor stator winding resistances U-V, V-W, W-U. These must be equal to within 3%.

6.2 Check dielectric strength by flash test at 1000 Vac from:

a Phase U (power connector pin) U to motor body.

b Phase U to thermal sensor (feedback connector pins Thermal Sensor + and Thermal Sensor -).

c Phase U to brake connections (power connector pins B+ & B-).

If flash test is not possible then check that insulation resistance is greater than 1megaohm.

6.3 Check dielectric strength by flash test at 500Vac or with a 500Vdc supply from motor body to:

d Brake connections (power connector pins B+ and B-)

e Thermal sensor (feedback connector pins Thermal Sensor + and Thermal Sensor -)

f Resolver (feedback connector pins R2 and S1.

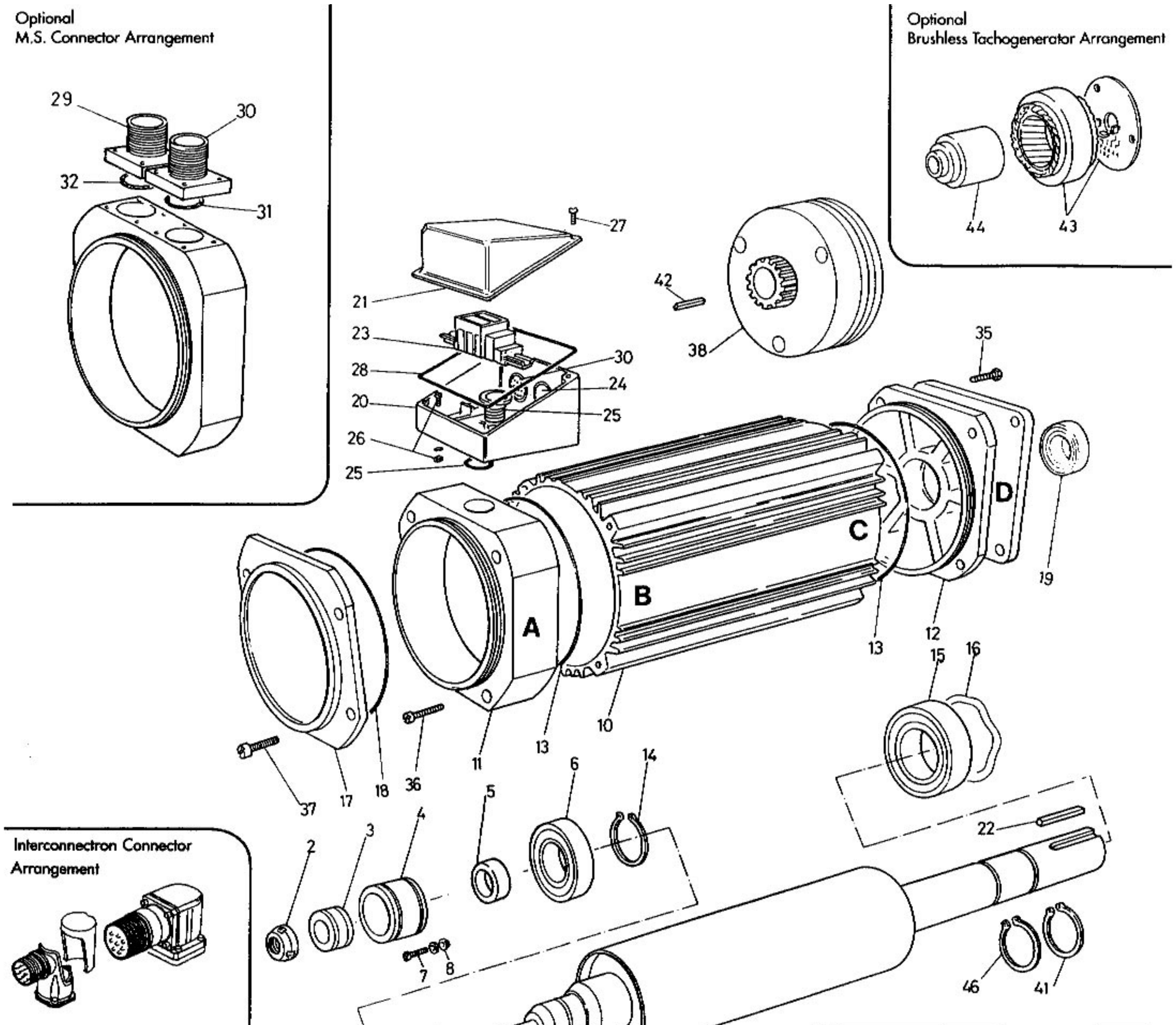
6.4 If flash test is not possible then check that insulation resistance is greater than 1megaohm.

SEM controlled motor technology

SEM Limited, Faraday Way, Orpington, Kent BR5 3QT England
Telephone: +44 (0)1689 884700 • Fax: +44 (0) 1689 884884
E-mail: info@sem.co.uk • Internet http://www.sem.co.uk

HD/HR142 parts list

ITEM NO.	DESCRIPTION
1	Rotor Assembly
2	Clamp Nut
3	Resolver Rotor
4	Resolver Body
5	Spacer 1Resolver only)
6	Bearing Non Drive End
7	Resolver Body Fixing Screws
8	Resolver Body Synchro Clamp
10	Motor Body
11	Non Drive End Housing
12	Drive End Cover
13	‘O’ Ring
14	Circlip
15	Bearing Drive End
16	Wave Washer
17	Non Drive End Enclosing Cover
18	‘O’ Ring
19	Oilseal
20	Terminal Box
21	Terminal Box Lid
22	Key
23	Terminal Block Assembly
24	Blanking Plug
25	Conduit Nipple and ‘O’ Ring
26	Earth Lead Screw and Clamp
27	Terminal Box Lid Fixing Screw
28	Terminal Box Lid Gasket
29	Motor M.S. Connector 7 Pin (Optional)
30	Feedback M.S. Connector 17 Pin
31	‘O’ Ring
32	‘O’ Ring
35	Fixing Screw (Drive End)
36	Fixing Screw (Non Drive End Housing)
37	Fixing Screw (Non Drive End Enclosing Cover)
38	Brake (Optional)
40	Circlip (Non Drive End)
41	Circlip (Drive End)
42	Brake Key (Optional)
43	Tacho Stator and P.C.B. Assembly (Optional)
44	Tacho Rotor Assy (Optional)
45	Tacho Fixing Adaptor
46	Brake Circlip (Optional)



TORQUE TABLE:

HD/HR 55 – M2.5	Tighten to 2.2 Nm (7 in lbs)
HD/HR 70 – M4	Tighten to 2.2 Nm (19 in lbs)
HD/HR 92 – M5	Tighten to 5.0 Nm (44 in lbs)
HD/HR 115 – M5	Tighten to 5.0 Nm (44 in lbs)
HD/HR 142 – M6	Tighten to 8.0 Nm (71 in lbs)
BMR 190/HD190 – M10	Tighten to 25.0 Nm (221 in lbs)

SEM Limited, Faraday Way, Orpington, Kent BR5 3QT England
Telephone: +44 (0)1689 884700 • Fax: +44 (0) 1689 884884
E-mail: info@sem.co.uk • Internet http://www.sem.co.uk

BMR/HD/HR190

servicing instructions

1 GENERAL

1.1 Before starting work on the motor, these servicing instructions should be read and fully understood.

1.2 Servicing of SEM motors must be done only by suitably trained and qualified personnel, and only after such motors have been electrically isolated and removed from their mechanical drives.

1.3 The jaws of any vice or clamp must be suitably protected when used to grip any part of the motor.

1.4 When separating the motor end covers from the motor body, care must be taken to avoid damage to their mating surfaces.

1.5 NOTE. There are strong magnetic forces between the stator and the rotor of all SEM servomotors. Fingers should be kept clear of the gaps between the stator and end covers during assembly and disassembly of the rotor.

1.6 Dismantled components awaiting reassembly, should be kept in a safe, clean and dry location.

Various types of encoder are used, involving different procedures for dismantling, reassembly, connection, setting up and testing. Contact SEM with regard to relevant servicing procedures for the particular type of encoder involved.

2 MARKING

2.1 The following relationships must be marked with a marker pen or other suitable method before dismantling.

2.2 Drive end (DE) cover (A) to motor body (B).

2.3 Non-drive end cover (D) to motor body (C).

2.4 Enclosing Cover (17) to non-drive end (NDE) cover (11).

2.5 Prior to resolver dismantling, mark outside end faces of resolver stator (4) and resolver rotor (3)

3 DISMANTLING THE MOTOR

3.1 Remove M5 socket screws from NDE enclosing cover (17), remove the end cover and the O Ring.

3.2 Grip the drive end of the rotor shaft (1) in a suitably protected vice and loosen the nut (2). Leave this nut finger tight until the resolver is required to be removed. (Note that a special tool is required, available from SEM). Remove the unit from the vice at this point.

3.3 **Disconnection sequence, (MS Connectors option).** Remove 8 fixing screws and pull M.S. plugs (29 & 30) clear of non drive end housing sufficiently to allow access to wires for unsoldering of existing connectors. When the wires are unsoldered, the M.S. connectors can be removed. (It is important to note all connections prior to unsoldering).

3.4 **Disconnection sequence, (Terminal Box assembly option).** Remove terminal box screws (27) lid, (21) and gasket (28). Unsolder all connections from M.S. Connector (30) and release 3 motor leads and 2 brake leads from terminal block (23). To remove the terminal box (20) from the non drive end housing, remove screw and nut (25 & 26).

3.5 **Removal of Resolver.** Important. At all stages of removal and reassembly, the resolver unit must be handled with care. (See Para 14). Unscrew (7 & 8) and release resolver body (4) complete. Remove nut (2), noting that at this point the resolver rotor (3) is free, and will drop out of the resolver body unless held in place by hand. Remove the resolver and store in a safe place until re-assembly.

3.6 **Removal of Drive End Cover, (Non Brake models).** (Do not lever between body and end covers under any circumstance). Remove 4, M8 socket screws (36). Do not attempt to separate the N.D.E. housing from the motor body at this stage. Remove 4 screws (35) and separate the drive end cover from the motor body (10) and rotor shaft (1). Remove and discard the oil seal (19) and the O-ring (13) (note that the oil seal must be pressed out using a suitable tool. The rotor assembly is now free to be removed, via the non-drive end, but it is still attached to the N.D.E. cover by N.D.E. bearing (6).

3.7 **Removal of N.D.E. Housing. TAKE CARE!** The rotor itself is covered by a protective tape, and before any attempt is made at further withdrawal, the rotor must be properly supported and eased through the motor body so that the tape is not damaged in any way. This is most important. To remove rotor from N.D.E. cover, remove circlips (14) from N.D.E. cover to release N.D.E. bearing (6). Support the N.D.E. cover and rotor assembly in such a way as to allow the rotor to be gently tapped or pushed out of the housing. (Only use a hide mallet if tapping out is necessary).

3.8 **Removal of D.E. Cover (Brake Models)** Remove 6 screws which hold brake assembly to D.E. housing, then follow instructions as for non-brake model, (Para.7). When drive end cover is removed, the brake assembly (38) and bearing (15) are left on the rotor shaft (1). After removing circlip (41) the bearing itself can only be removed by use of a suitable tool. This will leave the brake assembly free to be removed from the rotor shaft after disconnection of the relevant 'spade' connectors. Then follow instructions as applicable to nonbrake motor (section 3.7).

4 RE-ASSEMBLY OF MOTOR

4.1 Note: New circlips, bearings, oil seals and O-ring must be fitted on re-assembly as standard procedure. Also ensure that all marks made under section 2 are in alignment as applicable. Fit bearing (6) into N.D.E. housing. Fit D.E. Bearing (15) onto rotor (1). Supporting inner race of N.D.E. bearing, press rotor assembly back into N.D.E. housing, fit circlip (40). Fit new O-ring (13).

4.2 Carefully re-insert assembled rotor and N.D.E. housing through the motor body at the same time feeding connection wires through the crescent shape hole in the N.D.E. housing, taking care not to trap wires or to damage the protective tape on the rotor when completing this assembly. Tighten screws, using correct torque (see torque table). Refit brake when fitted and fit bearing (15) (reconnect 'spade' connectors). Refit drive end housing (12) with wave washer (16) and O-ring (13) in position. Refit screws and tighten to correct torque (see torque table). Fit oil seal (19).

4.3 Refit Resolver. Slide Resolver body into non drive end of rotor shaft and screw into N.D. E. housing using screw (7) and clamps (8). Refit resolver rotor (3), refit nut (2) and tighten to correct torque (see torque table), gripping drive end of rotor shaft in a suitably protected vice (as section 3.2). Re-assemble M.S. connectors or terminal box assembly as applicable, in reverse sequence to sections 3.3 & 3.4.

5 RESETTING THE RESOLVER.

5.1 This only applies to a standard resolver supplied by SEM with the standard setting. For any other resolver, refer to the drive manufacturer.

5.2 For these procedures it is necessary to make connections and links to feedback connector pins. To avoid damage to these pins, it is advisable to make such connections and links via a suitable separate test socket which mates with the feedback connector multi-pin plug (30) and which has short leads connected to its sockets. Alternatively appropriate pins can be made available for connections and links by withdrawing them from plug (30) as in Section 3.3 and 3.4 "Disconnection".

5.3 If a brake is used, it must be temporarily held off during this operation by applying a 24V dc supply across the brake terminals.

5.4 Undo 4 screws (37) and pull back the enclosing cover (17) to give access to the resolver. With the above test plug connected to the feedback connector, link pins R1 to S3 & pins R2 to S2. Connect a signal generator (approx 5V 6kHz) between pins R1 and R2. Connect an AC voltmeter between pins S1 and R2.

5.5 At the power connector, link motor phase pins V and W and then connect a low voltage dc supply to motor phases at power connector pins U (+ve) and V+W (-ve). Adjust this voltage to give between 25% and 100% of motor rated current thereby causing the motor to turn to a preferred position.

5.6 Slacken the 3 screws (7) holding the resolver stator and then rotate it until the voltmeter gives a maximum reading. Reconnect the AC voltmeter to pins S4 and R2. Make a small final adjustment of the resolver stator to get a minimum reading. Retighten the screws, disconnect the test socket, the supplies, the voltmeter and links, let the brake (if used) be re-applied.

5.7 Attach the protective shield (if fitted) to the resolver and fix the enclosing cover (17) to the NDE cover in accordance with marks made in operation 2.4.

6 ELECTRICAL TESTS NECESSARY BEFORE CONNECTING MOTOR TO AMPLIFIER.

6.1 Measure motor stator winding resistances U-V, V-W, W-U. These must be equal to within 3%.

6.2 Check dielectric strength by flash test at 1000 Vac from:

a Phase U (power connector pin) U to motor body.

b Phase U to thermal sensor (feedback connector pins Thermal Sensor + and Thermal Sensor -).

c Phase U to brake connections (power connector pins B+ & B-).

If flash test is not possible then check that insulation resistance is greater than 1megaohm.

6.3 Check dielectric strength by flash test at 500Vac or with a 500Vdc supply from motor body to:

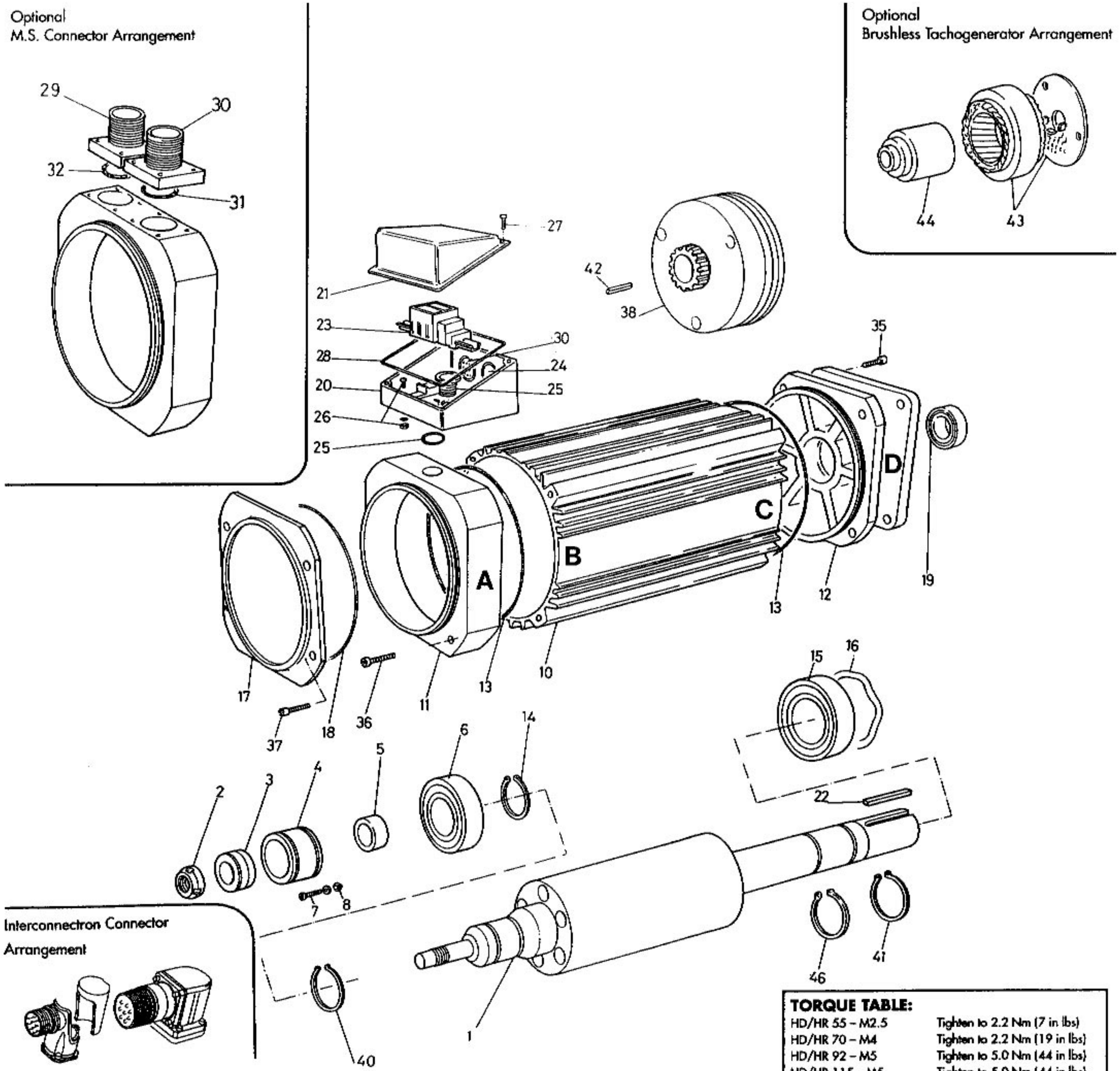
d Brake connections (power connector pins B+ and B-)

e Thermal sensor (feedback connector pins Thermal Sensor + and Thermal Sensor -)

6.4 Resolver (feedback connector pins R2 and S1.f flash test is not possible then check that insulation resistance is greater than 1megaohm.

SEM
controlled motor technology

SEM Limited, Faraday Way, Orpington, Kent BR5 3QT England
Telephone: +44 (0)1689 884700 • Fax: +44 (0) 1689 884884
E-mail: info@sem.co.uk • Internet http://www.sem.co.uk



TORQUE TABLE:	
HD/HR 55 – M2.5	Tighten to 2.2 Nm (7 in lbs)
HD/HR 70 – M4	Tighten to 2.2 Nm (19 in lbs)
HD/HR 92 – M5	Tighten to 5.0 Nm (44 in lbs)
HD/HR 115 – M5	Tighten to 5.0 Nm (44 in lbs)
HD/HR 142 – M6	Tighten to 8.0 Nm (71 in lbs)
BMR 190/HD190 – M10	Tighten to 25.0 Nm (221 in lbs)

BMR/HD/HR190 parts list

ITEM NO.	DESCRIPTION
1	Rotor Assembly
2	Clamp Nut
3	Resolver Rotor
4	Resolver Body
5	Spacer (Resolver only)
6	Bearing Non Drive End
7	Resolver Body Fixing Screws
8	Resolver Body Synchro Clamp
10	Motor Body
11	Non Drive End Housing
12	Drive End Cover
13	‘O’ Ring
14	Circlip
15	Bearing Drive End
16	Wave Washer
17	Non Drive End Enclosing Cover
18	‘O’ Ring
19	Oilseal
20	Terminal Box
21	Terminal Box Lid
22	Key
23	Terminal Block Assembly
24	Blanking Plug
25	Conduit Nipple and ‘O’ Ring
26	Earth Lead Screw and Clamp
27	Terminal Box Lid Fixing Screw
28	Terminal Box Lid Gasket
29	Motor M.S. Connector 7 Pin (Optional)
30	Feedback M.S. Connector 17 Pin
31	‘O’ Ring
32	‘O’Ring
35	Fixing Screw (Drive End)
36	Fixing Screw {Non Drive End Housing)
37	Fixing Screw (Non Drive End Enclosing Cover)
38	Brake (Optional)
40	Circlip (Non Drive End)
41	Circlip (Drive End)
42	Brake Key (Optional)
43	Tacho Stator and P.C.B. Assembly (Optional)
44	Tacho Rotor Assy (Optional)
45	Tacho Fixing Adaptor
46	Brake Circlip (Optional)

SEM Limited, Faraday Way, Orpington, Kent BR5 3QT England
Telephone: +44 (0)1689 884700 • Fax: +44 (0) 1689 884884
E-mail: info@sem.co.uk • Internet http://www.sem.co.uk

REMOVAL OF AC TACHO

Instructions common to HD 55, HD 70, HD 92, HR 92

Extreme care to be taken during the removal and re-assembly of the Tacho. When stripping Tacho Motor, Tacho parts must be removed first.

1. Disconnect leads at feedback connector
2. Undo screws holding PCB board and lift off
3. Undo screws holding Tacho stator in N.D.E. cover and lift out.
4. With suitable extractor, pull out the Tacho rotor, taking care not to damage these components.
5. Continue with dismantling of the motor.

Re-assembly

6. Replace the stator, fit tacho rotor and PCB in the correct position. The screws that clamp the stator to PCB must not be over tightened – this causes the PCB to distort. Use a suitable Loctite or similar screw lock adhesive, to prevent screws from loosening.
7. Refit rotor noting original position and using a power supply to position motor rotor as during removal. Lock rotor with clamp nut and tighten using correct torque. (See torque tables).
8. Refit stator, rotor and PCB Assembly. Refit screw aligning position of PCB relative to the end housing. Reset tacho using appropriate electrical device.

REMOVAL OF DC TACHO

(1) Remove cable from processing PCB

(2) Remove processing PCB by pulling it off the 3 connectors which support it. Then proceed as AC tacho.

REMOVAL OF AC TACHO

Instructions common to HD 92, HR 92, HD 115, HR 115 HD 142, HR 142, BMR 190/HD 190

Extreme care to be taken during the removal and re-assembly of the Tacho.

1. Mark the relationship of PCB to the end housing (11). Insert a strip or tube of non-magnetic material (e.g. card or plastic) in the air gap between stator and rotor to prevent demagnetising the rotor and damaging the windings. (ROTOR MUST BE PROTECTED FROM CONTACT WITH ANY FERROUS METAL TO PREVENT DEMAGNETISATION).
2. Unplug cables from the PCB and remove the 3 screws holding the PCD to the end housing. Carefully remove the PCB and stator assembly.
3. To mark the position of rotor, connect a D.C. power supply to motor terminals U(+ve) and V(-ve), adjust the voltage to give a current between 25% and 100% of the motor rated current. The rotor will move to a preferred position. If motor has a brake, it must be released to allow this to happen. Then mark position of tacho rotor relative to the end housing.
4. WE STRONGLY RECOMMEND THAT CUSTOMERS DO NOT REMOVE THE STATOR FROM THE PCB. However, if the Stator has to be removed, proceed as follows: To remove the stator from the PCB – mark position of stator relative to PCB, unscrew the screws holding the PCB to stator and separate.
   NOTE: IT IS RECOMMENDED THAT IF ANY PARTS OF THE TACHO ARE TO BE REPLACED, THE COMPLETE MOTOR BE RETURNED TO SEM FOR IN-HOUSE REPAIR.

Re-assembly

5. Replace the stator on PCB (if it was removed) in the correct position. The screws that clamp the stator to PCB must not be over tightened – this causes the PCB to distort. Use a suitable Loctite or similar screw lock adhesive, to prevent screws from loosening.
6. Refit rotor noting original position and using a power supply (as para. 3) to position motor rotor as during removal. Lock rotor with clamp nut and tighten using correct torque. (See torque tables).
7. Refit stator and PCB assembly protecting rotor from contact with stator as during removal. Refit screw aligning position of PCB relative to the end housing.

REMOVAL OF DC TACHO

(1) Remove cable from processing PCB

(2) Remove processing PCB by pulling it off the 3 connectors which support it. Then proceed as AC tacho.

WARNING

Servomotors contain magnetic material which will attract metal particles. Care should be taken when dismantling motors to avoid this.
All D.C. servomotors manufactured by SEM contain magnets which are air stable and can be dismantled without demagnetisation

SEM controlled motor technology

SEM Limited, Faraday Way,
Orpington, Kent BR5 3QT England
Telephone: +44 (0) 1689 884700
Fax: +44 (0) 1689 884884
E-mail: info@sem.co.uk
Internet: http://www.sem.co.uk

ISO 9001 UKAS

UL VERSIONS AVAILABLE